MORTALITY AND ECONOMIC CHANGE IN POST-WAR NETHERLANDS: 1950-1985

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The question arises as to whether the Netherlands, a country with highly developed welfare state and health care systems, should give evidence of changed mortality patterns resulting from recession during the 1980s. In this study we examine the impact of the early 1980s recession in the context of (1) business cycle activity, (2) economic growth patterns, and (3) changing epidemiologic risks since World War II.

To understand the economic consequences of the early 1980s, one must bear in mind that several phenomena are occurring simultaneously. First, the recession is increasing the rates of: unemployment (people who have lost, and are seeking, employment), movement out of the labor force altogether (e.g. through early retirement), business failures, and losses of salary, wage and investment income.

Secondly, the 1980s recession is in force at a time of general economic restructuring of western, industrialized countries (Bluestone and Harrison (1982) and Organization for economic cooperation and development (1985)). In this case, it is a dramatic decline in manufacturing employment concurrent with a much slower increase in services employment. In general, the combination of recessional and structural (or technological) job losses and business failures, and long term growth in income and employment in parts of the services industry lays the foundation for much increased economic inequality (Goldthorpe and Payne (1986)).

It is therefore necessary to estimate the effects of 1980s economic activity by taking into account several principal economic indicators (Brenner (1984 and 1987)). Further, it is important to estimate as much of the lagged effects as possible - short (under 3 years), medium-term (approximately 4-9 years), and long (10-15 years). Short lags of recession are assumed to influence mortality directly through stress and diminished social integration; medium-long lags would involve the indirect effects of increased illness-disability leading to further decline in social and economic position. In addition, long-term downward mobility leads to the solidification of lower socioeconomic status and to stresses which elevate health risks - e.g. use of alcohol and tobacco.

Finally, there is considerable epidemiologic evidence that consumption rates of alcohol, tobacco and fat (especially saturated fats) are major factors which underlie change in the `epidemic' pattern of major chronic diseases in the twentieth century (heart disease, cancer, stroke, diabetes, cirrhosis) (Doll (1987)).

Mackenbach and Kunst (1989) were unable to control for major changes in the multiple economic aspects of recession (especially per capita income, labor force participation, business failures). They were also unable to control either for the medium-long term effects of recession or for traditional epidemiologic risk factors. Under those constraints, their analysis was unable to identify a short-term relation between unemployment and mortality rates in the Netherlands in two recessional periods. In this chapter we investigate whether potential short-, medium- and long-term effects of recession are statistically linked to mortality, under controls for major economic indicators and epidemiologic risks.

Analysis

We use multiple regression time series analysis (Kmenta (1971); Shiller (1973) and Theil (1971)) to capture the coincident effects, on mortality, of change in several economic indicators and consumption patterns over a cumulative lag period covering approximately 0-15 years.

Mortality levels

We first ask whether it is possible to observe the impact of the most basic recessional factors - the labor force participation and unemployment rates - over a full distributed lag of 0-15 years. This model holds constant the consumption rates of spirits, beer, cigarettes and animal fat over 0-15 years. It can be seen that labor force participation is inversely related to mortality over 1-10 years; the unemployment rate is positively related to mortality over 0-15 years (insofar as these relations can be measured and are significant). Consumption rates of spirits over 1-4 years, beer over 0-3 and 5-12 years, cigarettes over 2-15 years, and animal fat over 0-14 years are positively related to mortality (table 1 and figure 1).

An examination of whether a splitting of the mortality into two periods leads to a significant difference in the model coefficients, utilizes the traditional Chow test (Chow (1960)). Regardless of which of the years 1965/1966 through 1976/1977 are used to split the series, no significant difference is found in the model coefficients between the two divided periods (table 1c). One can see on a coefficient-by-coefficient basis that the difference between periods is relatively small - e.g. comparing the periods 1950-1965 and 1966-1985 (tables 1a and 1b).

Similarly, we can inquire as to the forecasting capacity of our model (table 1) by comparing its performance to a `naive' extrapolative mathematical model. We are especially concerned with the question of whether the model as applied to the pre-1981 period could predict with reasonable accuracy to the post-1981 era - i.e. specifically, the era of the international recession and its aftermath. In fact, we can observe that our model's forecasts of 1, 2, 3, 4 and 5 year's duration are superior to that of the purely mathematical model (values are well below 1.0 of Theil's U; see table 1d).

The next issue is whether it is possible to observe, separately, the short-, medium- and long-term relations between mortality rates and the variables which have lengthy consolidated lag structures. Especially interesting in this regard is the recessional variable of unemployment and the consumption of beer and fat. In the case of unemployment, we can observe significant relations at lags of years 0-2 (short-term), 3-8 (medium-term) and 9-15 (long-term). The long-term relations are twice as powerful as those for the short- and medium-term. Short- and long-term relations can also be observed for beer (0-3 and 5-12 years) and fat (0-3 and 5-14 years). The model in which these clusters of relations are seen includes national income per capita (2-12 years), labor force participation (1-10 years), and consumption of spirits (1-4 years) and cigarettes (2-15 years) (see table 2).

Annual change model: first differences

Another useful test of the robustness of our general model involves determination of whether each of the specific relations can be found when the mortality data have been transformed to annual changes (i.e. first differences). This transformation removes the long-term trend in the mortality rate so that we focus only on the attempt to statistically explain annual fluctuations in that rate. We do, in fact, observe that significant relations occur between changes in national economic indicators and those in

the mortality rates, with controls for changes in the usual consumption factors (to the extent that their lagged relations are statistically significant). (See table 3 and figure 2).

The Chow tests of differences in coefficients between (split) periods (table 3a) and the forecast statistics for the post 1980 era (table 3b), show the annual change equation to be statistically robust and applicable to the international recession and its aftermath.

Acceleration model: second differences

An even more rigorous test of the general model questions whether its relations are significant after transformation of mortality rates to second differences. This transformation measures acceleration in the rate of annual changes in mortality rates. In this case, multicollinearity is at a minimum because serial correlation (i.e. correlation among lags of each independent variable) is virtually zero. This test does show that all principal variables are significant, with theoretically correct signs and lag periods, largely replicating the level and annual change relations to mortality (table 4 and figure 3). The second difference model also shows considerable robustness in the Chow test of differences in coefficients between periods (table 4a) and the forecast statistics for the years following 1980 (table 4b).

Discrete unemployment lags: first differences

The next question is whether it is only possible to observe the health effects of a key recessional variable - namely, unemployment - in a cumulative measure. That is, can we also measure the health effects of individual years of lagged unemployment rates, especially during and proximally close to the occurrence of recession? For this purpose, a model is developed which controls at least for medium-term unemployment lags - i.e. 4-9 years - but permits testing of the individual contributions of the discrete unemployment lags of 0, 1, and 2 years. This model also controls at least for the economic factors of labor force participation and national income per capita. The model controls, as far as statistical significance allows, the per capita consumption of spirits, beer, cigarettes, and fat.

The careful observation of the unemployment lags under three years is sufficiently important that it is done for each of the age groups 25-34, 35-44, 45-54, and 55-64 - ages at which mortality is, in principle, preventable. In all four age groups we see an individually significant relation at a one-year lag. Additionally, the zero lag is significant in the 35-44 and 45-54 groups, and the two-year lag is significant in the 45-54 group. In all ages, the 4-9 medium-term year lag period is significant as are the labor force participation rate and national income (tables 5- 6- 7- 8).

Suicide rates

To further validate the overall mortality models, equations were run with similar models focused on suicide rates in the ages 45-54 and 55-64. Income per capita, labor force participation, unemployment rates and the stock market index were the principal predictors, and alcohol consumption was the control factor. While all variables performed in a theoretically correct manner, the relations for unemployment and labor force participation are especially interesting. The relations for labor force participation start almost immediately (i.e. at zero or one year's lag); those for unemployment start at two or as late as six years cumulative lag (tables 9, 10 and figures 4, 5). It seems clear that movement outside of the labor force has much more acute implications for suicide in the Netherlands than does unemployment. This may be due to the possibility that persons who have left the labor force completely are less (physically) healthy and/or more socially isolated.

Conclusions

It is clear from the foregoing analysis that, in the Netherlands, recession has important adverse implications for health in the short, medium and long term over the span 1950-1985. These relations can be seen using various indices of national economic activity, especially per capita real income and wages, and rate of unemployment, labor force participation and business failures. The relations are measured in the context of, and control for, multiple economic indices as well as consumption per capita of alcohol, tobacco, and fats.

Mackenbach and Kunst (1989) are therefore largely correct when they infer that since the basic relations between recession and mortality in the Netherlands may be gradual and long-term, the short-term relations are more difficult to estimate. It is true that the long-term relations are stronger than those in the medium-term or short-term for e.g. unemployment. It is also the case that without controls for multiple economic indices - especially income - and traditional epidemiologic risks of consumption (alcohol, tobacco, fats), it would be extremely difficult to measure accurately the short-term influence (under three years) of unemployment changes in the Netherlands.

The need for control for multiple indicators of economic activity is not simply a statistical requirement. Rather, it is important to identify the behavior of incomes which, in the recovery subsequent to the 1980-82 recession, increased while unemployment was maintained at historically high levels. The resulting enlargement of economic inequalities was further aggravated by declines in labor force participation, especially among males. The importance of income and labor force participation is not only evident in their influences on total mortality. Suicide rates in the 45-54 and 55-64 age groups respond much more rapidly to labor force participation decline than to unemployment increases. Wage changes, for both sexes, influence 45-54 suicide rates within two years, while male wage changes are related to 55-64 suicide rates within two years.

This analysis indicates that, as in other industrialized countries, economic growth is a major source of mortality rate decline and recession exerts a powerful influence on retarding that decline. The recession of the early 1980s, in conjunction with and followed by increased economic inequalities, has served to further offset the extensive benefits of long-term economic growth.

Table 1

Time series multiple regression total mortality rates: 55-64 the Netherlands, 1950-1985

	Order of entry of variable	Lag*** (years)	Coefficient	Standard error	T statistic
Economic					
Labor force participation rate	4	1- 10	-.4210E-05	.1517E-06	-27.7549
Unemployment rate*	6	0- 15	.1112E-02	.2858E-04	39.1729
Consumption					
Spirits per capita*	5	1- 4	.5273E-03	.6277E-04	8.3940
Beer per capita S*	2	0- 3	.2639E-03	.6871E-05	38.4132
Beer per capita L	3	5- 12	.5072E-04	.1545E-05	32.8271
Cigarettes per capita	1	2- 15	.1198E-04	.2440E-06	49.0768
Fat per capita*	7	0- 14	.2165E-03	.1396E-04	15.5045
Other controls					
Constant			. 1297	.3226	40.2095
Time			-.2721E-01	.8945E-03	-30.4145
RHO**			-.6192	.1514	-4.0912

R^2	.9975
Durbin-Watson	2.3232
F (9, 26) =	1580.89

* Differences

** Beach-McKinnon transformation used to minimize residual autoregression

*** Shiller distributed lag estimation

S: Short lags

L: Long lags

FIGURE 1

Actual rates and fit of level model (table 1)

Ages 55-64, the Netherlands 1950-1985

Actual vs fitted mortality

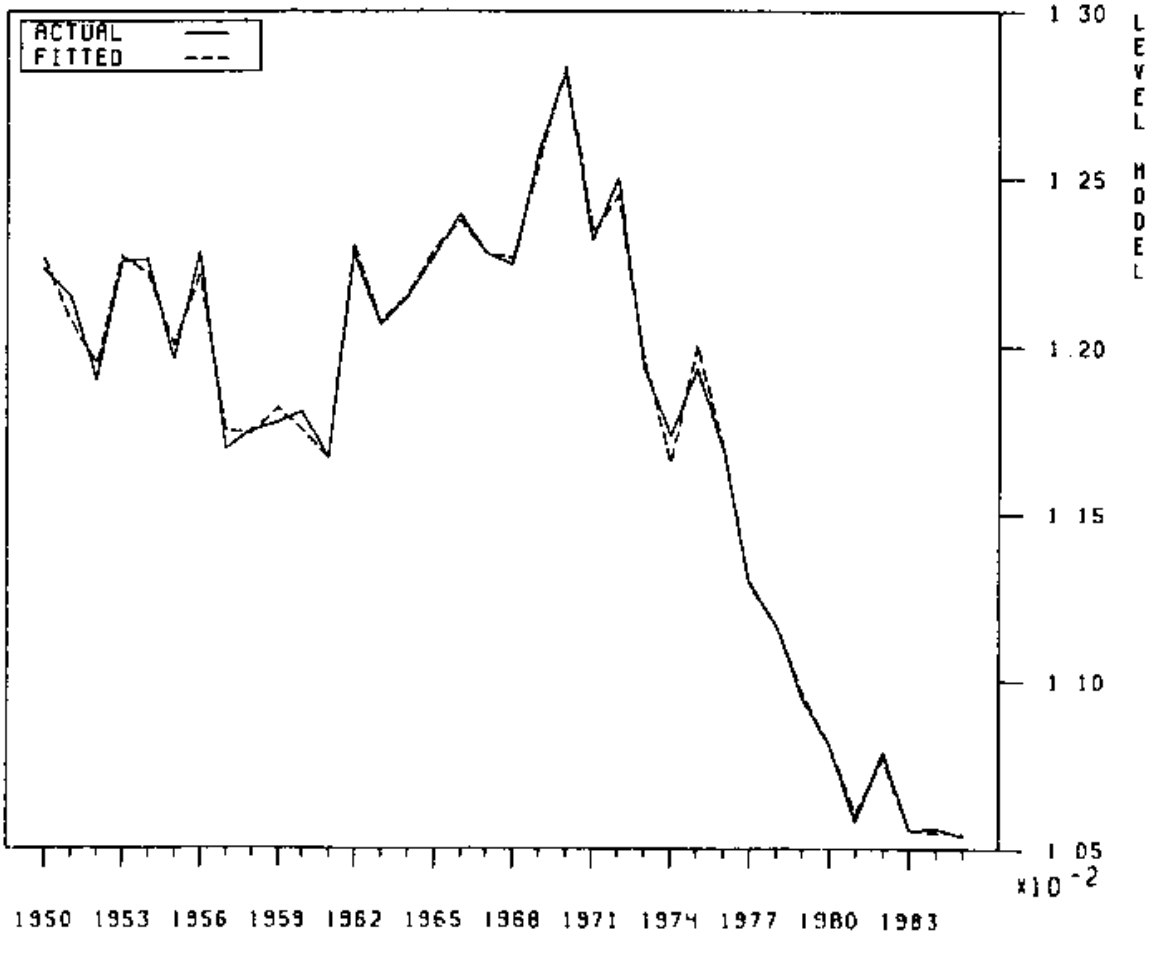


Table 1a

Time series multiple regression total mortality rates: 55-64 the Netherlands, 1950-1965, split series test: period A

	Order of entry of variable	Lag*** (years)	Coefficient	Standard error	T statistic
Economic					
Labor force participation rate	4	1- 10	-.4452E-05	.4339E-06	-10.2614
Unemployment rate*	6	0- 15	.1214E-02	.1289E-03	9.6441
Consumption					
Spirits per capita*	5	1- 4	.6190E-03	.1360E-03	4.5513
Beer per capita S*	2	0- 3	.3076E-03	.3870E-04	7.9499
Beer per capita L	3	5- 12	.4825E-04	.6788E-05	7.1089
Cigarettes per capita	1	2- 15	.1249E-04	.9894E-06	12.6278
Fat per capita*	7	0- 14	.2656E-03	.4174E-04	6.3627
Other controls					
Constant			.1384	.1142E-01	12.1185
Time			-.2921E-01	.2819E-02	-10.3611
RHO**			-.5969	.5765	-1.0354

R^2 .9761
Durbin-Watson 2.3121

* Differences
** Beach-McKinnon transformation used to minimize residual autoregression
*** Shiller distributed lag estimation
S: Short lags
L: Long lags

Table 1b

Time series multiple regression total mortality rates: 55-64 the Netherlands, 1966-1985, split series test: period B

	Order of Entry of Variable	Lag*** (years)	Coefficient	standard Error	T statistic
Economic					
Labor force participation rate	4	1- 10	-.4108E-05	.2662E-06	-15.4318
Unemployment rate*	6	0- 15	.1112E-02	.5932E-04	18.9050
Consumption					
Spirits per capita*	5	1- 4	.4286E-03	.1097E-03	3.9080
Beer per capita S*	2	0- 3	.2660E-03	.7948E-05	33.4671
Beer per capita L	3	5- 12	.4884E-04	.2228E-05	21.9179
Cigarettes per capita	1	2- 15	.1159E-04	.4787E-06	24.2040
Fat per capita*	7	0- 14	.2109E-03	.2274E-04	9.2764
Other controls					
Constant			.1297	.3226	40.2095
Time			-.2647E-01	.1442E-03	-18.3563
RHO**			-.6876	.2525	-2.7238

R^2 .9886
Durbin-Watson 2.5681

* Differences
** Beach-McKinnon transformation used to minimize residual autoregression
*** Shiller distributed lag estimation
S: Short lags
L: Long lags

Table 1c
Time series multiple regression total mortality rates: 55-64 the Netherlands, 1951-1985
CHOW TEST of differences in coefficients between periods

Samples	F(10, 16)
1950-1965/1966-1985	0.9476
1950-1966/1967-1985	0.9356
1950-1967/1968-1985	0.9789
1950-1968/1969-1985	1.1088
1950-1969/1970-1985	1.2126
1950-1970/1971-1985	1.55
1950-1971/1972-1985	1.43
1950-1972/1973-1985	0.8746
1950-1973/1974-1985	0.7742
1950-1974/1975-1985	0.7756

Critical values: .05 F (10,16) = 2.49
.01 F (10,16) = 3.69

Table 1d
Time series multiple regression total mortality rates: 55-64 the Netherlands, 1951-1985
Forecast statistics

Step	Mean error	Mean abs. error	RMS error	Theil U	N. obs.
1	.6065E-04	.6700E-04	.7367E-04	.4253	5
2	.4494E-04	.4494E-04	.4630E-04	.4024	4
3	.5750E-04	.5750E-04	.5818E-04	.2796	3
4	.5865E-04	.5865E-04	.5887E-04	.3287	2
5	.5054E-04	.5054E-04	.5054E-04	.1836	1

R^2 .9975
Durbin Watson 2.32
F (9, 26) = 1580.89

Table 2
Time series multiple regression total mortality rates: 55-64 the Netherlands, 1950-1985

	Order of entry of variable	Lag*** (years)	Coefficient	Standard error	T statistic
Economic					
National income per capita*	2	2- 12	-.7289E-06	.1650E-06	-4.4174
Labor force participation rate	9	1- 10	-.3078E-05	.3342E-06	-9.2598
Unemployment rate S*	5	0- 2	.1551E-03	.1755E-04	8.8404
Unemployment rate M*	11	3- 8	.1505E-03	.3194E-04	4.7117
Unemployment rate L*	6	9- 15	.3794E-03	.4220E-04	8.9911
Consumption					
Spirits per capita*	10	1- 4	.4129E-03	.1085E-03	3.8057
Beer per capita S*	3	0- 3	.2065E-03	.1437E-04	14.3660
Beer per capita L*	4	5- 12	.4878E-04	.2802E-05	17.4098
Cigarettes per capita	1	2- 15	.1008E-04	.4512E-06	22.3314
Fat per capita S*	8	0- 3	.6541E-04	.1331E-04	4.9146
Fat per capita L*	7	5- 14	.7070E-04	.1078E-04	6.5578
Other controls					
Constant			.1090	.6197E-02	17.5868
Time			-.2283E-01	.1674E-02	-13.6347
RHO**			.3983	.2216	-1.7970

R^2 .9934
Durbin-Watson 2.2917
F (13, 22) = 406.1210

* Differences
** Beach-McKinnon transformation used to minimize residual autoregression
*** Shiller distributed lag estimation
S: Short lags
M: Medium-term lags
L: Long lags

Table 3

Time series multiple regression total mortality rates: 55-64 the Netherlands, 1951-1985, annual changes

	Order of entry of Variable	Lag*** years)	Coefficient	Standard error	T statistic
Economic					
National income per capita S*	4	1- 4	-.9847E-06	.2250E-06	-4.3774
National income per capita M*	5	6- 8	-.3598E-06	.1822E-06	-1.9747
Unemployment rate*	2	0- 15	.1585E-02	.1757E-03	9.0210
Business failure rate	8	2- 4	.4099	.2288	1.7918
Consumption					
Spirits per capita	7	0- 2	.2713E-03	.1479E-03	1.8350
Beer per capita*	3	0- 16	.7583E-03	.8896E-04	8.5241
Cigarettes per capita	1	7- 15	.5109E-05	.3544E-06	14.4170
Fat per capita*	6	2- 4	.5332E-04	.1665E-04	3.2030
Other controls					
Constant			.3384E-03	.2453E-04	-13.7967
RHO**			-.4181	.2088	-2.0027

R^2	.8976	*	Second differences; mortality rate and other independent variables are transformed to first differences
Durbin-Watson	2.0755		
F (9, 26) =	35.08		
S: Short lags		**	Iterative search procedure used to minimize residual autoregression
M: Medium-term lags			

FIGURE 2

Actual changes in mortality rates and fit of annual change model (table 3) Ages 55-64, the Netherlands 1950-1985

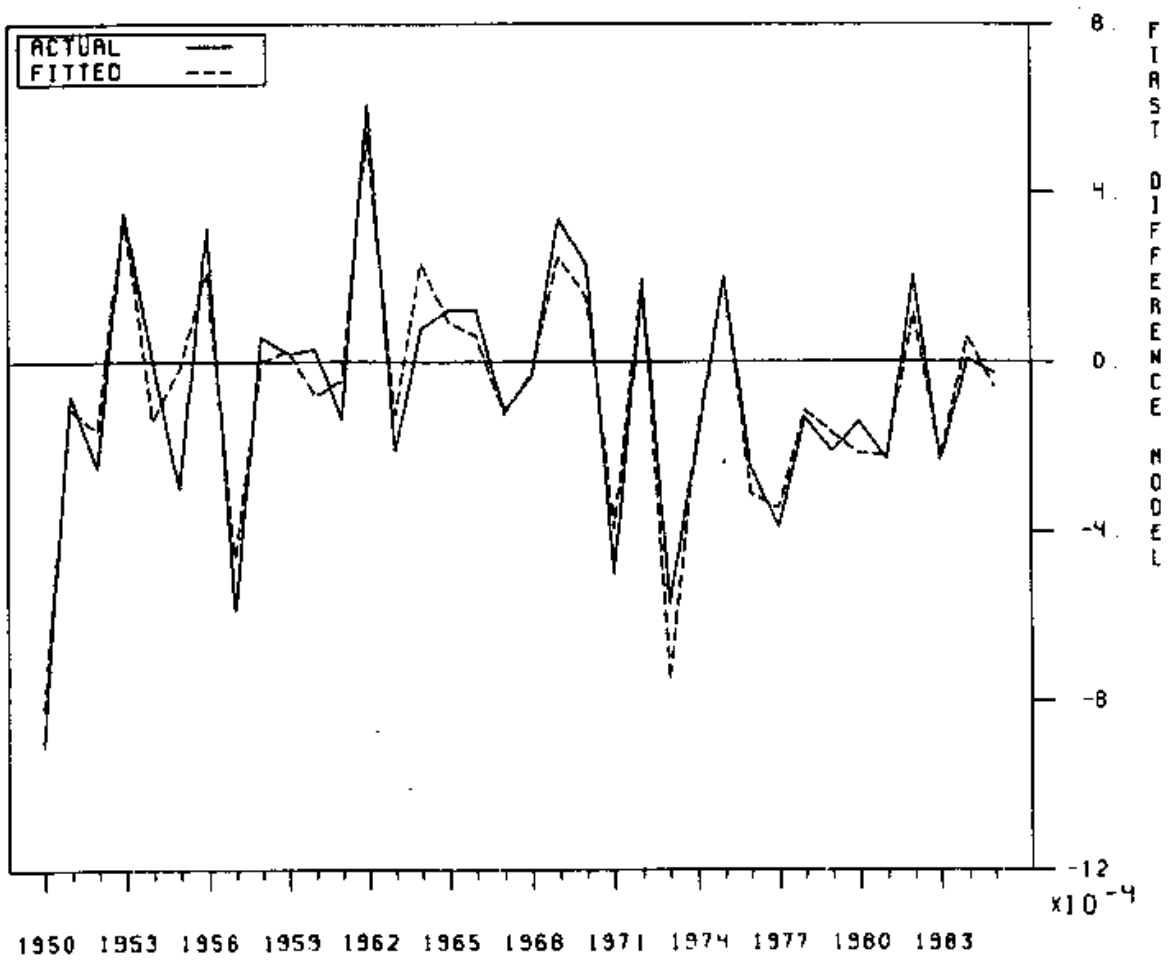


Table 3a

Time series multiple regression total mortality rates: 55-64 the Netherlands, 1951-1985, annual changes
CHOW TEST of differences in coefficients between periods

Samples	F(9, 16)
1950-1965/1966-1985	2.32
1950-1968/1969-1985	1.28
1950-1970/1971-1985	1.26
1950-1972/1973-1985	2.05
1950-1973/1974-1985	0.3088
Critical values:	.05 F (9, 16) = 2.54 .01 F (9 ,16) = 3.78

Table 3b

Time series multiple regression total mortality rates: 55-64 the Netherlands, 1951-1985, annual changes
Forecast statistics

Step	Mean error	Mean abs. error	RMS error	Theil U	N. obs.
1	.5406E-04	.9969E-04	.1069E-03	.3567	5
2	-.5087E-06	.6777E-04	.7830E-04	.3474	4
3	-.5441E-05	.4580E-04	.5642E-04	.2844	3
4	-.5311E-04	.5311E-04	.6442E-04	.3645	2
5	-.1062E-04	.1062E-04	.1062E-04	.9249	1

R^2 .90
Durbin-Watson 2.08
F (9, 26) = 35.08

Table 4

Time series multiple regression total mortality rates: 55-64 the Netherlands, 1951-1985, second differences

	Order of entry of variable	Lag*** years)	Coefficient	Standard error	T statistic
Economic					
National income per capita*	2	0- 14	-.1327E-04	.7750E-06	29.8965
Labor force participation rate*	7	0- 5	-.7552E-05	.1704E-05	-4.4326
Unemployment rate*	4	1- 15	.3268E-02	.1007E-03	32.4562
Consumption					
Spirits per capita*	6	0- 4	.8448E.03	.1718E-03	4.9168
Beer per capita*	3	1- 12	.2293E-03	.5259E-04	4.3591
Cigarettes per capita*	1	1- 20	.4328E-05	.1448E-06	29.8965
Fat per capita*	5	0- 12	.2029E-03	.3022E-04	6.7130
Other controls					
RHO**			.3020	.2006	1.5050

R^2 .9779
Durbin-Watson1 .9957
F (8, 28) = 194.56

* Third differences; mortality rate and other independent variables are transformed to second differences

** Beach-MacKinnon transformation used to minimize residual autoregresssion

*** Shiller distributed lag estimation

FIGURE 3

Acceleration of changes (second differences) in mortality rates and fit of second difference model (table 4)
Ages 55-64, the Netherlands 1950-1985

Actual vs fitted mortality

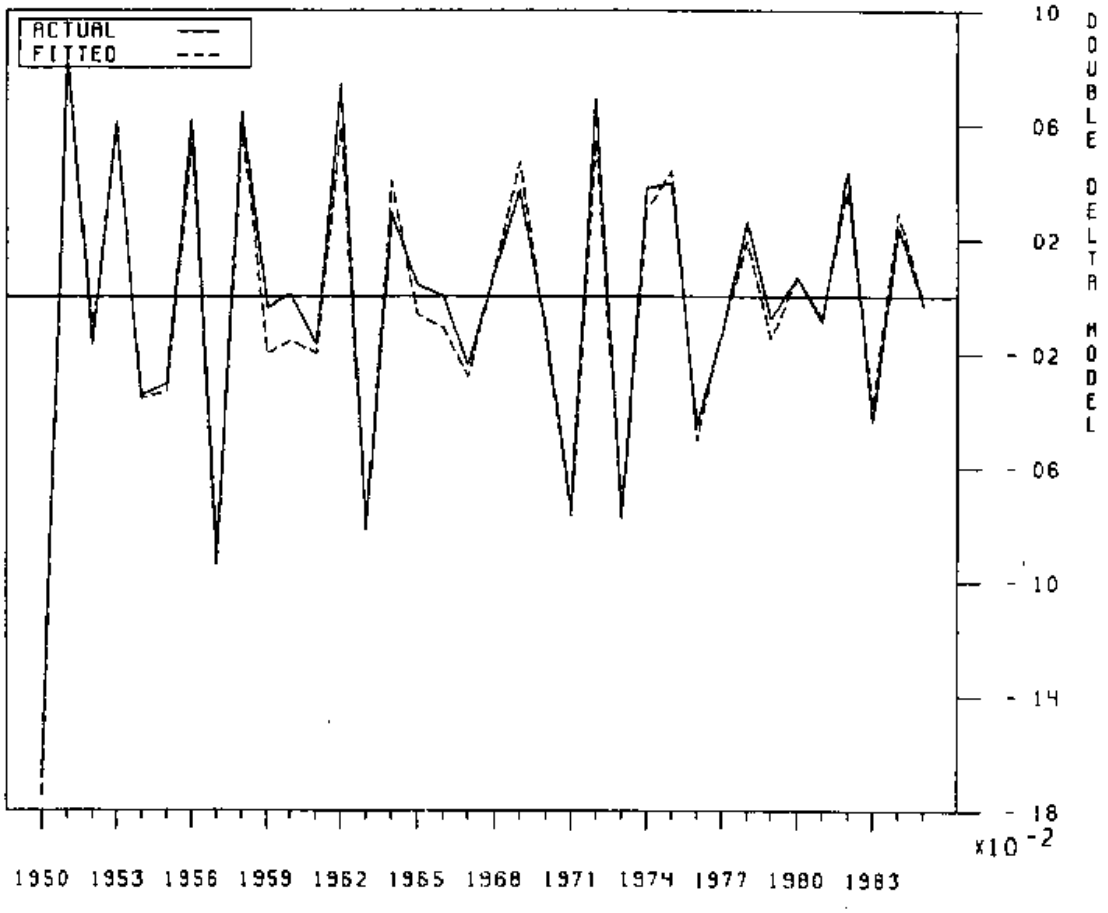


Table 4a

Time series multiple regression total mortality rates: 55-64 the Netherlands, 1951-1985, second differences
CHOW TEST of differences in coefficients between periods

Samples	F(8, 20)
1950-1965/1966-1985	0.8464
1950-1968/1969-1985	0.7836
1950-1970/1971-1985	0.8728
1950-1972/1973-1985	0.4171
1950-1973/1974-1985	0.5301
1950-1975/1976-1985	0.5575
1950-1976/1977-1985	0.4894

Critical values: .05 F (8, 20) = 2.54
.01 F (8 ,20) = 3.56

Table 4b

Time series multiple regression total mortality rates: 55-64 the Netherlands, 1951-1985, second differences
Forecast statistics

Step	Mean error	Mean abs. error	RMS error	Theil U	N. obs.
1	-.1061E-04	.5714E-04	.6905E-04	.1221	5
2	-.1153E-04	.6929E-04	.6920E-04	.2041	4
3	-.4863E.04	.4863E-04	.5333E-04	.1206	3
4	-.3993E-04	.3928E-04	.4713E-04	.3721	2
5	-.1364E-04	.1364E-04	.1364E-04	.1318	1

Table 5

Time series multiple regression total mortality rates: 25-34 the Netherlands, 1951-1985, annual changes

	Order of entry of variable	Lag*** (years)	Coefficient	Standard error	T statistic
Economic					
National income per capita	4	1- 7	-.2016E-07	.40049-08	-5.0339
Labor force participation rate	2	0- 4	-.1259E-05	.1152E-06	-10.9245
Unemployment rate S*	1	1	.1749E-04	.5237E-05	3.3404
Unemployment rate M*	5	4- 9	.1060E-03	.1706E-04	6.2120
Consumption					
Beer per capita	3	0- 12	.1294E-04	.1669E-05	7.7543
Cigarettes per capita	6	7- 12	.8862E-06	.9357E-07	9.4705
Other controls					
RHO**			-.1760	.1907	-.9231

R^2	.8213	*	Second differences; mortality rate and other
Durbin-Watson	1.9346		independent variables are transformed to first
F (7, 29) =	23.84		differences
S: Short lags		**	Beach-MacKinnon transformation used to minimize
M: Medium-term lags			residual autoregression
		***	Shiller distributed lag estimation

Table 6

Time series multiple regression total mortality rates: 35-44 the Netherlands, 1951-1985, annual changes

	Order of entry of variable	Lag*** (years)	Coefficient	Standard error	T statistic
Economic					
National income S*	6	0- 3	-.5666E-07	.2412E-07	-2.3470
National income per capita L	3	5- 11	-.5967E-07	.73599-08	-8.1122
Labor force participation rate	7	0- 8	-.1594E-05	.1191E-06	-13.3816
Unemployment rate S	1	0	.7318E-05	.4300E-05	1.7073
Unemployment rate S	2	1	.4957E-04	.5347E-05	9.2713
Unemployment rate M*	8	4- 9	.2181E-03	.2434E-04	8.9618
Consumption					
Beer per capita	4	0- 14	.1628E-04	.2089E-05	7.7939
Cigarettes per capita	5	6- 18	.1229E-05	.1053E-06	11.6686
Other controls					
RHO**			-.2696	.2221	-1.2139

R^2 .8839
Durbin-Watson 1.9622
F (9, 27) = 30.50
S: Short lags
L: Long lags

* Second differences; mortality rate and other independent variables are transformed to first differences

** Beach-MacKinnon transformation used to minimize residual autoregression

*** Shiller distributed lag estimation

Table 7

Time series multiple regression total suicide rates: 45-54 the Netherlands, 1951-1985, annual changes

	Order of entry of variable	Lag** (years)	Coefficient	Standard error	T statistic
Economic					
National income per capita*	11	2- 13	-.7994E-06	.11789-06	-6.7842
Wage rate (male)*	7	0- 5	-.1069E-03	.1428E-04	-7.4851
Labor force Participation rate	4	2- 8	-.4968E-06	.4959E-07	-10.0178
Unemployment rate S	1	0	.1500E-04	.5586E-05	2.6846
Unemployment rate S	2	1	.2873E-04	.5820E-05	4.9360
Unemployment rate S	3	2	.1881E-04	.6744E-05	2.7901
Unemployment rate M*	12	4- 9	.1728E-03	.3208E-04	5.3872
Stock market index	6	2- 4	-.1951E-05	.2928E-06	-6.6632
Consumption					
Wine per capita	8	2- 6	.1418E-03	.1289E-04	11.0016
Beer per capita	10	0- 13	.1418E-04	.8707E-06	16.2827
Cigarettes per capita	5	7- 15	.1966E-05	.8490E-07	23.1543
Fat per capita	9	3- 11	.3188E-05	.3312E-06	9.6293
Other controls					
Constant			-.1266E-03	.6963E-05	-18.1847

R^2 .9697
Durbin-Watson 1.9982
F (12, 23) = 94.27
S: Short lags
M: Medium-term lags

* Second differences; mortality rate and other independent variables are transformed to first differences

** Shiller distributed lag estimation

Table 8.

Time series multiple regression total mortality rates: 55-64 the Netherlands, 1951-1985, annual changes

	Order of entry of variable	Lag** (years)	Coefficient	Standard error	T statistic
Economic					
National income per capita	4	2- 14	-.5647E-06	.5836E-07	-9.6751
Wage rate (male)*	9	4- 6	-.7397E-03	.3764E-03	-1.9747
Labor force Participation rate	6	1- 7	-.7703E-06	.2624E-06	-2.0354
Unemployment rate S	1	1	.4811E-04	.2518E-04	1.9102
Unemployment rate M*	10	4- 9	.1412E-02	.1238E-03	11.4084
Business failure rate*	3	0- 2	3.9008	.5173	7.5404
Consumption					
Spirits per capita	7	1- 2	.4327E-03	.2044E-03	2.1168
Beer per capita	5	0- 13	.2472E-04	.3006E-05	8.2234
Cigarettes per capita	2	7- 15	.3402E-05	.4253E-06	7.9979
Fat per capita	8	5- 12	.1009E-04	.1936E-05	5.2104
Other controls					
RHO**			.1707	.2423	.7046

R^2 .8650
Durbin-Watson 1.8780
F (11, 25) = 21.29
S: Short lags
M: Medium-term lags

* Second differences; mortality rate and other independent variables are transformed to first differences

** Iterative search procedure used to minimize residual autoregression

*** Shiller distributed lag estimation

Table 9

Time series multiple regression total suicide rates: 45-54 the Netherlands, 1950-1985

	Order of entry of variable	Lag** (years)	Coefficient	standard error	T statistic
Economic					
Wages per capita (male)*	2	2- 4	-.8187E-04	.1149E-04	-7.1226
Wages per capita (female)*	6	0- 2	-.2896E-04	.9838E-05	-2.9442
Labor force participation rate*	7	1- 8	-.1057E-05	.1289E-06	-8.1994
Unemployment rate	4	2- 8	.1769E-04	.1805E-05	9.8043
Stock market index	5	2- 4	-.3005E-06	.6753E-07	-4.4499
Consumption					
Spirits per capita	3	0- 4	.8344E-04	.7569E-05	11.0237
Beer per capita	1	0- 5	.5737E-06	.9917E-07	5.7851
Other controls					
Constant			.3532E-04	.6410E-05	5.5104

R^2 .9543 * Differences

Durbin-Watson 2.0883 ** Shiller distributed lag estimation

F (7, 2) = 90.45

FIGURE 4

Suicide rate and fit of model (table 9)
Ages 45-54, the Netherlands, 1950-1985

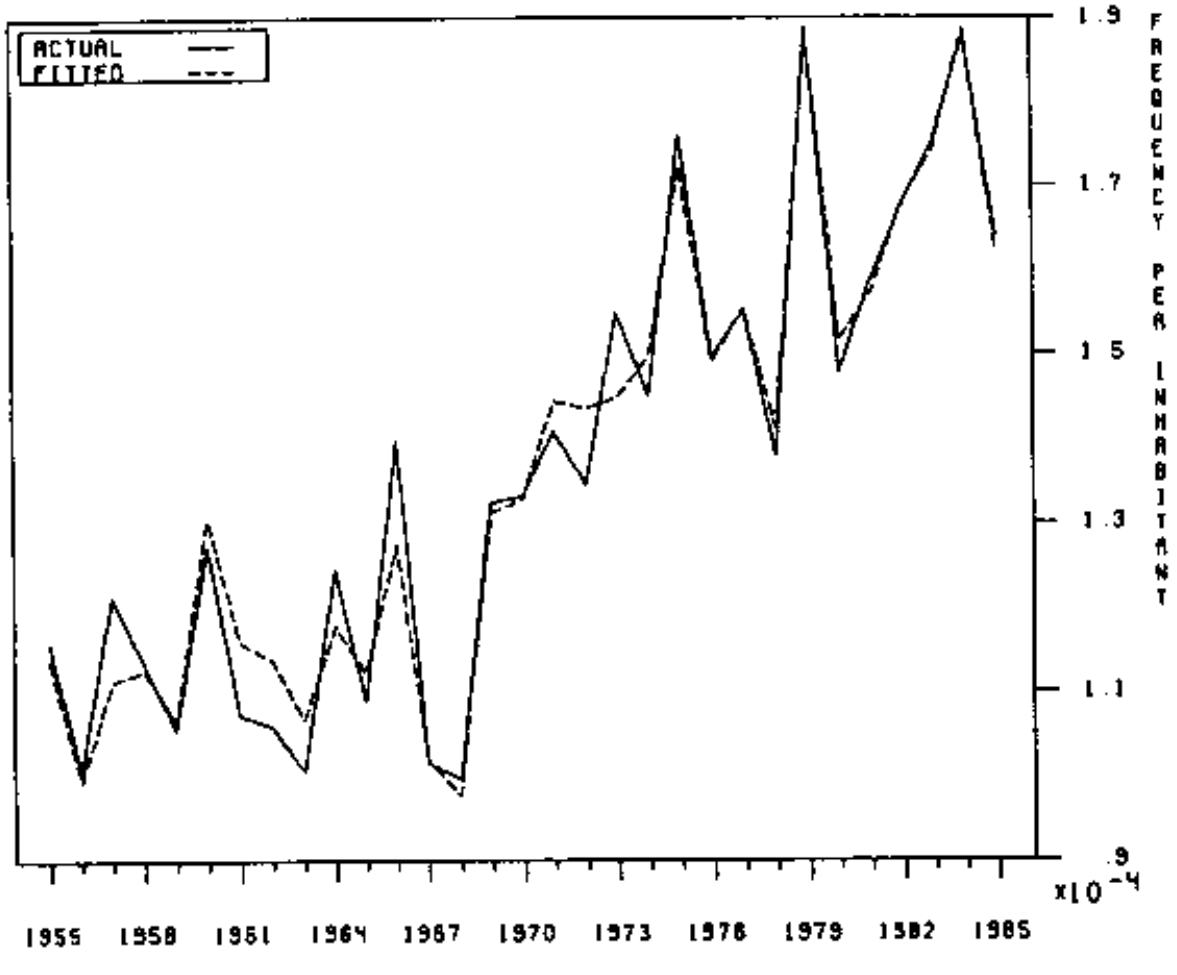


Table 10

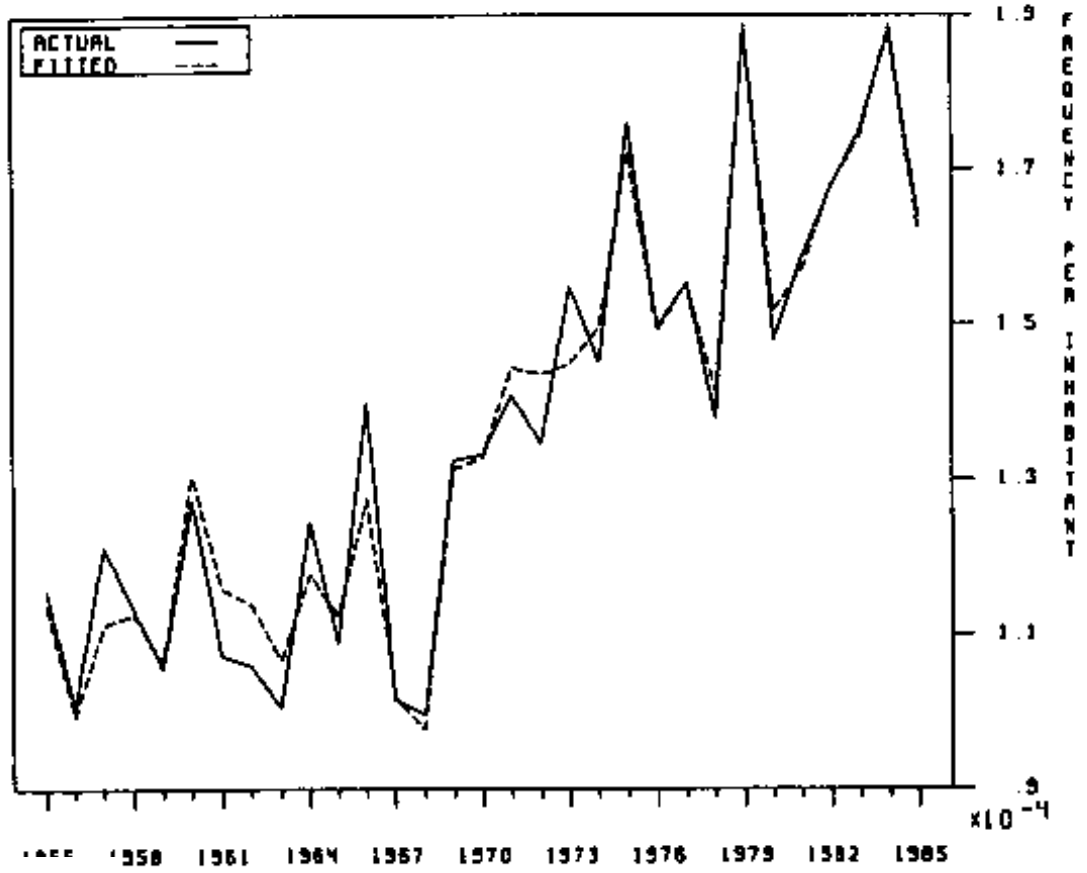
Time series multiple regression total suicide rates: 55-64 the Netherlands, 1950-1985

	Order of entry of variable	Lag** (years)	Coefficient	Standard error	T statistic
Economic					
National income per capita	5	2- 10	-.1671E-07	.2495E-08	-6.6994
Wages per capita (male)*	6	2- 4	-.6697E-04	.1005E-04	-6.6668
Labor force participation rate*	2	0- 8	-.5760E-06	.7877E-07	-7.3121
Unemployment rate	4	6- 9	.1442E-04	.1833E-05	7.8681
Stock market index	3	0- 3	-.1866E-06	.3317E-07	-5.6249
Consumption					
Spirits per capita	1	0- 4	.2704E-04	.4310E-05	6.2726
Beer per capita	7	2- 6	.3097E-05	.3357E-06	9.2251
Other controls					
Constant			.1175E-03	.4733E-05	24.8305

R^2 .9255
Durbin-Watson 2.04
F (7, 23) = 54.24

* Differences
** Shiller distributed lag estimation

FIGURE 5
Suicide rate and fit of model (table 10)
Ages 55-64, the Netherlands, 1950-1985



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APPENDIX 1

Data sources

The data sources for each of the variables used in this study are given below:

Variables	Data Source
Population, by age and sex	World Health Organization Annual Statistics; United Nations Demographic Yearbook, 1960 for the years 1940-1951; Statistical Yearbook of the Netherlands (update).
Mortality, by age and sex	
1936-1947	United Nations Demographic Yearbook 1951;
1948-1951	United Nations Demographic Yearbook, Historical Supplement;
1952-1982	World Health Organization Annual Statistics;
1983-1984	United Nations Demographic Yearbook;
1985	Statistical Yearbook of the Netherlands, 1987.
Suicide, by age and sex	World Health Organization Annual Statistics; United Nations Demographic Yearbook.
National income	International Monetary Fund, International Financial Statistics.
Labor force participation	OECD, Labor Force Statistics.
Wages by sex	
1926-1946	Inkomens Jaren Statistiek in Tijdreeksen;
1947-1985	Netherlands Abstract.
Stock prices	
1920-1957	Jaar Statistiek van Nederland;
1958-1985	Netherlands Abstract.
Business failures	Netherlands Abstract.
Consumer price index	International Monetary Fund, International Financial Statistics.
Unemployment	International Labor Organization Yearbook, series used for 1931 to 1985 was: 4.47, 8.89, 10.45, 10.63, 12.10, 12.79, 11.28, 10.68, 7.43, 5.75, 3.39, 2.12, 0.58, 2.21, 3.82, 1.47, 0.84, 0.77, 1.10, 1.50, 1.76, 2.71, 2.13, 1.50, 1.02, 0.74, 0.99, 1.96, 1.51, 0.98, 0.73, 0.69, 0.72, 0.75, 0.78, 0.81, 1.70, 1.54, 1.13, 0.98, 1.30, 2.25, 2.29, 2.80, 3.90, 4.19, 4.01, 4.01, 4.03, 4.59, 6.89, 9.40, 13.72, 14.09, 12.80.
Cigarettes, beer, spirit, and wine consumption	Netherlands Abstract.
Fat consumption	Jaren Statistiek Van Nederland, 1975; Netherlands Abstract.